Assessment Part 1

Introduction

This project presents the process of mapping new enterprises created in London between 2004-2016 and the office spaces receiving planning permission in the same period, using R and ArcMap accordingly. The study begins by introducing the data sources, then demonstrates and compares the workflows and limitations of each map.

Data

The number of new enterprises in London were part of a business demographic dataset from the Office of National Statistics. *Birth of enterprises* was identified as the registration of a business which did not exist the year before. Data on planning permissions by development type was provided by the Greater London Authority. Accuracy on the attributes was established through the metadata(Pepijn van Oort 2006), which explained the developments' classification, aiming to reduce the MAUP(David Wong 2009). Finally, the shapefile for the London basemap (using the British National Grid) comes from the ONS geoportal.

R

A grid of four chloropleth maps was created, to compare the births of enterprises across London throughout the years.The input was a shapefile of the administrative boundaries and a csv file of business demographics in England. A **strong asset** of R is its **packages**. To start with, *"tidyverse"* saved time from manually removing text from numeric cells.

The original dataset was noticeably complicated and R made it easy to **subset** the dataframe, without editing the original csv file. Also, with the *grep()* function the London Boroughs were separated from the rest of the rows.

The last step was to create a SF keeping the necessary data and the geometry, by joining the London Boundaries and Enterprise dataframes, based on their common field "code". The benefit of packages such as *ggplot* was that it enabled to plot, style (*viridis* package) and change the map any time, by adding **layers**. Among other packages, with *"reshape2"* the dataframe was rearranged according to years, and *"gridExtra"* positioned elements in the grid, such as the north symbol. However, even in the case of dynamic maps, a setback noticed in the CLI was the user's inability to **navigate** and experience space, in a way that a GUI software can offer.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1									**Numbers**							
2	Code	Area	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
3																
4	E09000001	City of London	1,175	1,305	1,225	1,305	2,005	1,790	1,730	1,780	1,900	2,300	2,610	4,965	4,850	
5	E09000002	Barking and Dagenham	480	500	485	510	720	615	635	835	845	1,185	1,310	1,665	1,775	
6	E09000003	Barnet	2,435	2,425	2,150	2,305	2,610	2,410	2,440	2,835	2,995	3,735	3,985	4,460	4,455	
7	E09000004	Bexley	940	900	895	870	795	720	840	945	895	1,340	1,455	1,605	1,640	
8	E09000005	Brent	1,800	1,740	1,565	1,750	1,950	1,685	1,630	1,915	1,975	2,515	2,585	2,895	3,020	
9	E09000006	Bromley	1,590	1,500	1,515	1,750	1,540	1,320	1,475	1,580	1,670	2,080	2,190	2,340	2,420	
10	E09000007	Camden	2,840	2,570	2,485	2,745	3,035	2,735	2,930	3,200	3,140	3,990	4,375	5,445	6,050	
11	E09000008	Croydon	1,630	1,525	1,580	1,595	1,575	1,400	1,495	1,755	1,765	2,305	2,390	2,695	2,905	
12	E09000009	Ealing	2,115	1,885	1,775	2,035	2,155	1,940	1,715	2,210	2,225	3,200	3,110	3,420	3,590	
13	E09000010	Enfield	1,400	1,380	1,385	1,285	1,425	1,310	1,390	1,530	1,615	2,270	2,305	2,520	2,650	
14	E09000011	Greenwich	975	1,000	940	995	1,045	920	1,060	1,215	1,250	1,740	1,690	2,260	2,225	
15	E09000012	Hackney	1,445	1,360	1,330	1,520	1,740	1,510	1,570	1,970	2,140	2,845	3,245	4,105	4,670	
16	E09000013	Hammersmith and Fulham	1,865	1,745	1,470	1,785	1,960	1,560	1,640	1,830	1,885	2,290	2,380	2,560	2,350	
17	E09000014	Haringey	1,345	1,285	1,130	1,270	1,425	1,275	1,325	1,570	1,500	2,110	2,190	2,350	2,415	
18	E09000015	Harrow	1,370	1,325	1,200	1,310	1,435	1,455	1,470	1,605	1,730	2,170	2,390	2,605	2,710	
19	E09000016	Havering	1,055	895	885	990	1,090	955	890	1,005	1,085	1,460	1,485	1,720	1,845	
20	E09000017	Hillingdon	1,215	1,105	1,165	1,220	1,395	1,230	1,190	1,520	1,495	1,920	2,075	2,310	2,490	
21	E09000018	Hounslow	1,310	1,325	1,175	1,360	1,510	1,310	1,415	1,885	1,820	2,210	2,320	2,525	2,615	
22	E09000019	Islington	1,870	1,890	1,640	1,800	1,940	1,665	1,730	2,180	2,335	3,400	3,715	5,470	3,800	
23	E09000020	Kensington and Chelsea	1,660	1,490	1,445	1,585	1,645	1,450	1,620	1,665	1,685	2,095	2,165	2,355	2,305	
24	E09000021	Kingston upon Thames	880	865	850	1,025	1,025	905	885	985	980	1,185	1,270	1,370	1,410	
25	E09000022	Lambeth	1,850	1,580	1,520	1,930	1,855	1,445	1,555	1,945	4,255	5,115	5,570	3,425	3,120	
26	E09000023	Lewisham	1,135	1,070	1,065	1,230	1,290	1,030	985	1,350	1,415	1,825	1,870	2,045	2,095	
27	E09000024	Merton	1,205	1,200	1,240	1,330	1,370	1,085	1,215	1,505	1,530	1,945	1,995	2,225	2,160	

| Metadata | Regional Enterprise Indices | **Enterprise births by year** | Enterprise deaths by year | Active Enterprises by year | 2002 Survival Rates | ... ⊕ |

Figure 1: Initial dataset, before cleanup and subsetting

	code1	Area	variable	value	geometry
27	E09000027	Richmond upon Thames	2004	1475	list(list(c(523109.3, 523126.6, 523132.9, 523166.1, 523161, ...
28	E09000028	Southwark	2004	1945	list(list(c(532226.7, 532243.2, 532244.3, 532264.5, 532293, ...
29	E09000029	Sutton	2004	855	list(list(c(527321.8, 527323.6, 527327.8, 527340.1, 527352, ...
30	E09000030	Tower Hamlets	2004	1855	list(list(c(536779.3, 536780, 536799.9, 536822.6, 536859.9, ...
31	E09000031	Waltham Forest	2004	1130	list(list(c(537921.1, 537947.5, 537965.4, 537940.2, 537922....
32	E09000032	Wandsworth	2004	2630	list(list(c(530053.1, 530067.4, 530076.8, 530098.3, 530145....
33	E09000033	Westminster	2004	5850	list(list(c(526735.2, 526772.7, 526876.7, 526954, 527045.2, ...
52	E09000001	City of London	2008	2005	list(list(c(532140.3, 532141.5, 532142.4, 532146.6, 532158....
53	E09000002	Barking and Dagenham	2008	720	list(list(c(548881.8, 548881.2, 548997.2, 549000.4, 549019, ...
54	E09000003	Barnet	2008	2610	list(list(c(524579.9, 524594.3, 524607.4, 524619.1, 524630, ...
55	E09000004	Bexley	2008	795	list(list(c(547801.8, 547927, 547948.8, 547954.4, 547961.8, ...
56	E09000005	Brent	2008	1950	list(list(c(520284.7, 520319.4, 520347.8, 520383.4, 520432....
57	E09000006	Bromley	2008	1540	list(list(c(541382.1, 541389, 541390.3, 541396.7, 541410.6, ...
58	E09000007	Camden	2008	3035	list(list(c(527180.7, 527198.7, 527203.3, 527211.5, 527221....
59	E09000008	Croydon	2008	1575	list(list(c(531442.9, 531471.7, 531501.1, 531509.9, 531516....
60	E09000009	Ealing	2008	2155	list(list(c(515000.1, 515000.1, 515026.9, 515076.6, 515106....

Figure 2: Final dataframe for faceted plot

New enterprises in London, by Borough
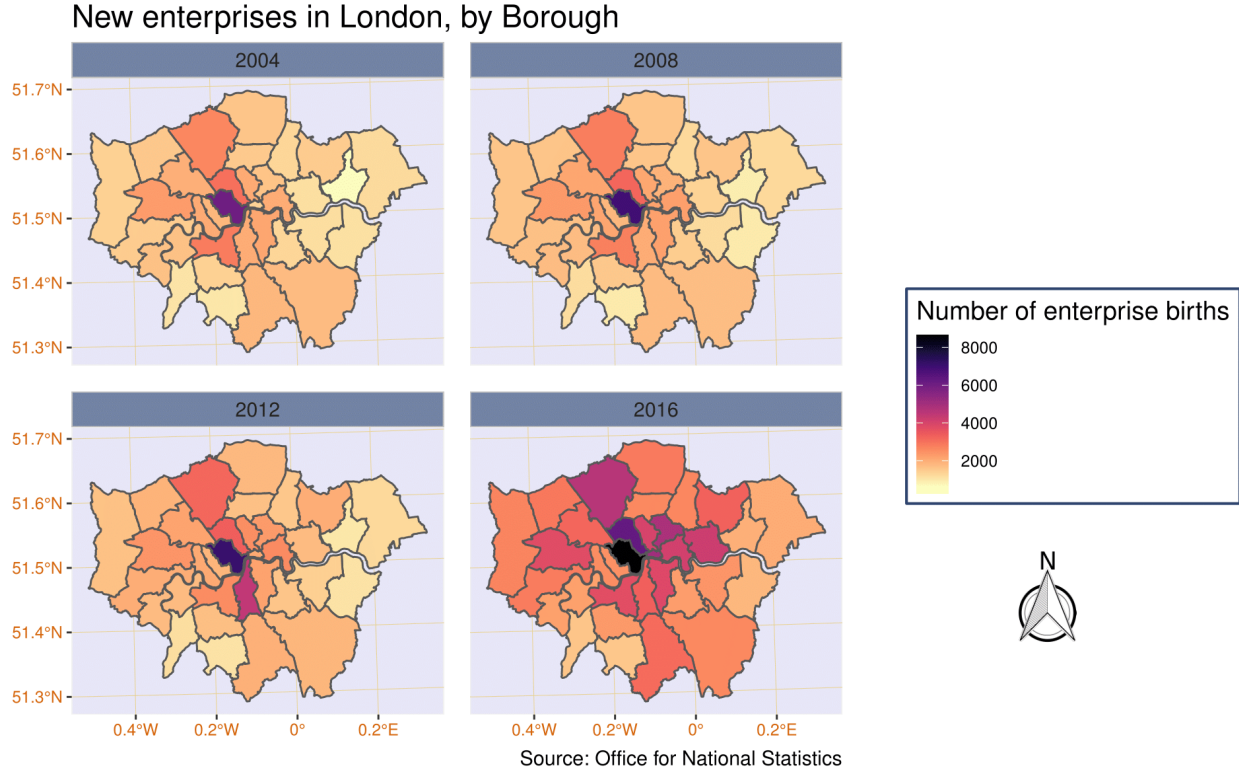
Source: Office for National Statistics

Figure 3: Final output using R.

ArcGis

The map presents the location and area of business offices, receiving planning permission between 2004-2016 in London. Considering that an object's attribute is better understood when presented within a context of other attributes (Paul Longley et al. 2015), the map depicts additionally the rest of permission types using purple dots.

Unlike R, the permissions data was cleaned externally in excel. After adding the data in ArcMap, a *feature class* of the total permissions was created. Using the"selection by *attributes*", a new feature class was created, exclusively for the business offices. The **display properties** of each class could be accessed from the contents table. It is noticeable that unlike CLI, ArcGiS made **navigation in multiple files** easy and provided a clear understanding of **hierarchy** through the ArcCatalog and the table of contents.

To visualize the area variations, ArcMap offered ready to use **symbology** options, easier to apply than those of CLI. In this case, the office area was illustrated with different sized bubbles. Given that there was a considerable values variation, the jenks classification was used (Michael J de Smith, Michael F Goodchild, and Paul A Longley 2018).Regarding the layout, ArcMap provided a greater freedom on **positioning** and adding **complementary elements** such as captions.
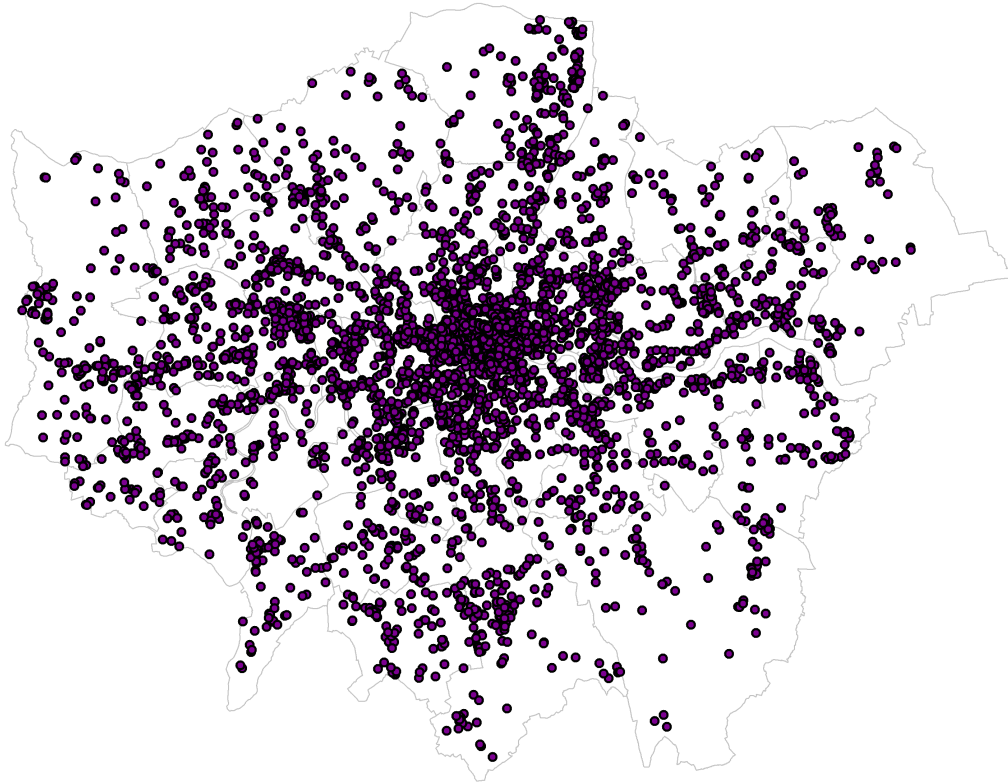
Figure 4: Sample plot of total planning permissions, as points diplayed from XY data.

Figure 5: Selection by multiple attributes (data for years 2004,2008,2012,2014)
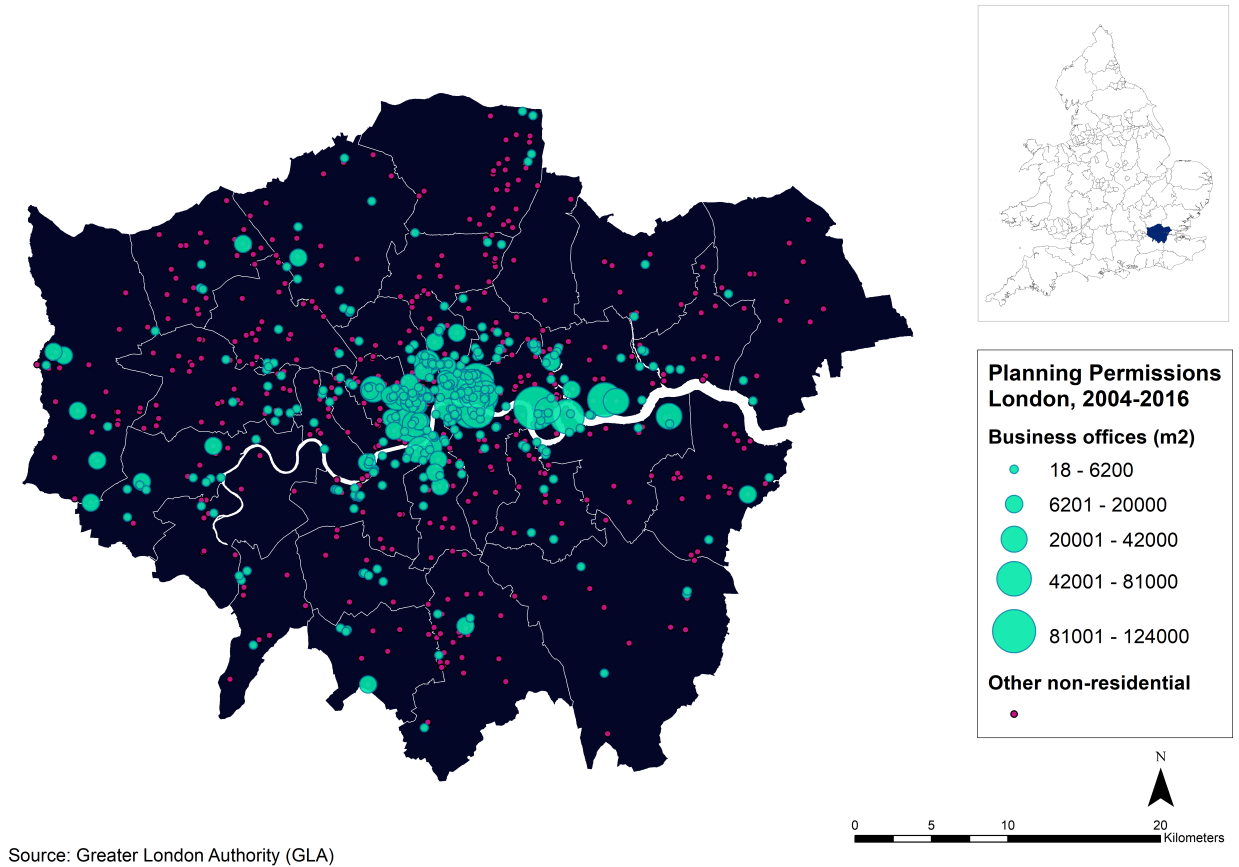
Source: Greater London Authority (GLA)

Figure 6: Final output using ArcMap

Conclusion

Mapping in R entails great possibilities, evolving through **packages** created by its own users and having an extended **support community** to clarify issues. GUI software like ArcMap seem to lack the **creative** possibilities of CLI but provide the user with a friendlier **interface** and a better understanding of the space the map addresses.

Note: RMD file of the map created in R can be found here: (https://github.com/sisikas/enterprises)

Words 597

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